No separate payment will be made for temporary shoring for wall construction. Temporary shoring for wall construction will be incidental to the contract unit price for *CIP Gravity Retaining Walls*.

The contract unit price for *CIP Gravity Retaining Walls* does not include the cost for ditches, fences, handrails, guardrail or barriers associated with CIP gravity walls as these items will be paid for elsewhere in the contract.

Where it is necessary to provide backfill material from sources other than excavated areas or borrow sources used in connection with other work in the contract, payment for furnishing and hauling such backfill material will be paid as extra work in accordance with Article 104-7. Placing and compacting such backfill material is not considered extra work but is incidental to the work being performed.

Payment will be made under:

Pay Item	Pay Unit
CIP Gravity Retaining Walls	Square Foot

SECTION 454
SEGMENTAL GRAVITY RETAINING WALLS

454-1 DESCRIPTION

Construct segmental gravity retaining walls consisting of segmental retaining wall (SRW) units supported by aggregate footings. Provide CIP concrete slope protection as required. Design, if required, and construct segmental gravity retaining walls based on actual elevations, wall dimensions and batter in accordance with the contract, accepted submittals and if included in the plans, standard segmental gravity wall detail.

Define “block wall” as a segmental gravity retaining wall and “standard block wall” as a block wall that meets the standard segmental gravity retaining wall details. Define “blocks” as SRW units, “cap blocks” as SRW cap units and “Block Vendor” as the vendor licensing the block producer. Define “slope protection” as CIP concrete slope protection.

454-2 MATERIALS

Refer to Division 10.

Item	Section
Geotextiles, Type 2	1056
Joint Fillers	1028-1
Low Modulus Silicone Sealant	1028-3
Portland Cement Concrete, Class B	1000
Segmental Retaining Wall Units	1040-4
Select Materials	1016
Subsurface Drainage Materials	1044

Provide Type 2 geotextile for separation geotextiles. Use Class VI select material for No. 57 stone and Class B concrete for slope protection. Provide PVC pipes, fittings, outlet pipes and concrete pads for subsurface drainage materials. For PVC pipes behind block walls, use pipes with perforations that meet AASHTO M 278.

Provide cap blocks that meet the material requirements for blocks. Use blocks from producers approved by the Department and licensed by the Block Vendor. Notify the Engineer of the name and NCDOT ID number of the SRW unit production facility before beginning block production. Provide blocks with a depth (front to back) of at least 12 inches and cap blocks with a depth of at least 8 inches.

Use approved SRW units for standard block walls. Blocks for standard block walls are approved for either 2 foot or 5 foot maximum wall heights with the wall height as shown in the

standard segmental gravity wall details. The list of approved SRW units with maximum wall heights is available from the Geotechnical website.

Do not mix blocks from different Block Vendors on the same block wall. Damaged blocks with excessive discoloration, chips or cracks as determined by the Engineer will be rejected.

Provide adhesives recommended by the Block Vendor. Store adhesives in accordance with the manufacturer's instructions. Load, transport, unload and store block wall materials so materials are kept clean and free of damage.

454-3 PRECONSTRUCTION REQUIREMENTS

(A) Block Wall Surveys

The plans typically show a plan view, typical sections, details, notes and an elevation or profile view (wall envelope) for each block wall. Before beginning block wall design or construction, survey existing ground elevations along wall face locations and other elevations in the vicinity of block wall locations as needed. For proposed slopes above or below block walls, survey existing ground elevations to at least 10 feet beyond slope stake points. Based on these elevations, finished grades and actual block wall dimensions, details and batter, submit wall envelopes for acceptance by the Engineer. Use accepted wall envelopes for design, if required, and construction.

(B) Block Wall Designs

If the plans do not include standard segmental gravity wall details, submit design calculations and working drawings for block wall designs at least 30 days before starting block wall construction. Do not begin block wall construction until a design submittal is accepted by the Engineer.

Design block walls in accordance with the plans and Article 11.11 of the *AASHTO LRFD Bridge Design Specifications* unless otherwise required. Neglect material above top of footing for stability computations. Design block walls for the wall batter required by the Block Vendor and clearances shown in the plans. Do not locate blocks or footings outside right-of-way or easement limits.

Use No. 57 stone for aggregate footings beneath blocks. Use 10 inch thick footings that are continuous at steps and extend at least 6 inches in front of and at least 9 inches behind bottom row of blocks. Embed bottom of footings at least 18 inches below bottom of walls shown in the plans. When noted in the plans, locate a 4 inch diameter continuous perforated PVC drain pipe in the No. 57 stone in back of footings.

Fill block core spaces with No. 57 stone and between and behind blocks with No. 57 stone for a horizontal distance of at least 12 inches so stone is continuous in all directions. Assume a unit weight of 100 pcf for No. 57 stone. Separation geotextiles are required between No. 57 stone and backfill or natural ground, and between stone and overlying fill or pavement section except when concrete pavement, full depth asphalt or cement treated base is placed directly on stone.

Use cap blocks at top of walls. Step top of walls as shown in the plans and double stack cap blocks at steps so cap blocks are continuous at steps. Extend top of walls 4 inches to 12 inches above where finished grade intersects back of blocks or cap blocks. When single faced precast concrete barrier is required in front of and against block walls, fill voids between barrier and wall faces with Class V select material.

Submit working drawings and design calculations for acceptance in accordance with Article 105-2. Submit working drawings showing plan views, wall profiles with required resistances, typical sections, No. 57 stone and geotextile locations and details of footings, blocks, cap blocks, etc. If necessary, include details on working drawings for slope protection and obstructions extending through walls or interfering with footings. Submit design calculations for each wall section with different geometry or material parameters to the Engineer. When

designing block walls with computer software, a hand calculation is required for the tallest wall section. Provide block wall designs sealed by an engineer licensed in the state of North Carolina.

454-4 CONSTRUCTION METHODS

Control drainage during construction in the vicinity of block walls. Direct run off away from block walls, No. 57 stone and backfill. Contain and maintain stone and backfill and protect material from erosion.

Excavate as necessary for block walls in accordance with the plans and accepted submittals. Notify the Engineer when foundation excavation is complete. Do not place No. 57 stone for footings until excavation dimensions and foundation material are approved by the Engineer.

Construct aggregate footings at elevations and with dimensions shown in the plans and accepted submittals. If a drain is required, install wall drainage systems consisting of drains and outlet components as shown in the plans and accepted submittals and in accordance with Section 815. Compact No. 57 stone for footings with a vibratory compactor to the satisfaction of the Engineer.

Stack blocks with no negative wall batter (wall face leaning forward) so the final wall position is as shown in the plans and accepted submittals. Place blocks with a maximum vertical joint width of 3/8 inch. Stagger blocks to create a running bond by centering blocks over joints in the row below as shown in the plans and accepted submittals. Construct block walls with the following tolerances:

A. Blocks are level from front to back and between units when checked with a 4 foot long level,

B. Final wall face is within 2 inches of horizontal and vertical alignment shown in the plans and accepted submittals, and

C. Wall batter is within 2 degrees of batter required by the Block Vendor.

Overlap adjacent separation geotextiles at least 18 inches at seams and hold geotextiles in place with wire staples or anchor pins as needed. Place No. 57 stone between and behind blocks in 8 inch to 10 inch thick lifts. Compact stone with hand operated compaction equipment to the satisfaction of the Engineer. Backfill for block walls behind No. 57 stone in accordance with Article 410-8.

Set cap blocks with a 1/2 inch to 1-1/2 inch overhang as shown in the plans and accepted submittals. Place cap blocks using adhesive in accordance with the manufacturer's instructions. Do not place cap blocks if surfaces caps will be attached to are wet or frozen or the air temperature measured at the wall location in the shade away from artificial heat is below 40°F. Before applying adhesive, clean surfaces cap blocks will adhere to and ensure surfaces are dry and free of oil, grease, dust and debris.

Pave slopes above and behind block walls with slope protection as shown in the plans and accepted submittals and in accordance with Article 462-3. Construct slope protection joints at a maximum spacing of 10 feet. Make 1/2 inch thick expansion joints that meet Article 420-10 for every third joint and 1/2 inch deep grooved contraction joints that meet Subarticle 825-10(B) for the remaining joints.

454-5 MEASUREMENT AND PAYMENT

Segmental Gravity Retaining Walls will be measured and paid in square feet. Block walls will be measured as the square feet of wall face area with the pay height equal to the difference between top of wall and top of footing elevations. Define "top of wall" as top of cap blocks.

The contract unit price for *Segmental Gravity Retaining Walls* will be full compensation for providing designs, if required, submittals, labor, tools, equipment and block wall materials, excavating, hauling and removing excavated materials, placing and compacting backfill

material and supplying footings, blocks, select material, wall drainage systems, geotextiles, cap blocks, slope protection and any incidentals necessary to construct block walls.

The contract unit price for *Segmental Gravity Retaining Walls* does not include the cost for ditches, fences, handrails, guardrail or barriers associated with block walls as these items will be paid for elsewhere in the contract.

Where it is necessary to provide backfill material behind No. 57 stone from sources other than excavated areas or borrow sources used in connection with other work in the contract, payment for furnishing and hauling such backfill material will be paid as extra work in accordance with Article 104-7. Placing and compacting such backfill material is not considered extra work but is incidental to the work being performed.

Payment will be made under:

Pay Item	Pay Unit
Segmental Gravity Retaining Walls	Square Foot

SECTION 455
PRECAST GRAVITY RETAINING WALLS

455-1 DESCRIPTION

Construct precast gravity retaining walls consisting of precast retaining wall (PRW) units supported by concrete footings. Provide CIP concrete slope protection as required. Design and construct precast gravity retaining walls based on actual elevations, wall dimensions and batter in accordance with the contract and accepted submittals. Define "precast gravity wall" as a precast gravity retaining wall and "PRW Unit Vendor" as the vendor licensing the precaster. Define "slope protection" as CIP concrete slope protection.

455-2 MATERIALS

Refer to Division 10.

Item	Section
Geotextiles, Type 2	1056
Joint Fillers	1028-1
Low Modulus Silicone Sealant	1028-3
Portland Cement Concrete	1000
Select Materials	1016
Precast Retaining Wall Units	1077
Subsurface Drainage Materials	1044

Provide Type 2 geotextile for separation geotextiles. Use Class A concrete for footings, Class B concrete for slope protection and Class VI select material for No. 57 stone. Provide PVC pipes, fittings, outlet pipes and concrete pads for subsurface drainage materials. For PVC pipes behind precast gravity walls, use pipes with perforations that meet AASHTO M 278.

Provide PRW cap and top units that meet the material requirements for PRW units. Use PRW units from producers approved by the Department and licensed by the PRW Unit Vendor. Produce PRW units with a final finish that meets Article 1077-11 except for unit faces. Provide PRW units with a vertical rock like face and a concrete gray color with no tints, dyes or pigments. Do not begin unit production until sample PRW units of the type, face and color proposed for the project are approved by the Engineer.

Do not mix PRW units from different PRW Unit Vendors on the same precast gravity wall. Damaged PRW units with excessive discoloration, chips or cracks as determined by the Engineer will be rejected. Load, transport, unload and store precast gravity wall materials so materials are kept clean and free of damage.